

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology
Standard Reference Materials Program
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SRM Number: 3112a
MSDS Number: 3112a
SRM Name: Chromium Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of chromium. Each unit consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a nominal 10 mg/mL of chromium. The addition of chromium to nitric acid forms chromium nitrate, which will precipitate upon evaporation or drying of the solution; thus, the mixture has three components.

Material Name: Chromium Standard Solution

Other Designations:

Chromium: Cr

Chromium Nitrate: Chromium trinitrate; chromium salt; chromium (III) nitrate; chromic nitrate; chromium nitrate nonahydrate (CAS 7769-02-8).

Nitric acid: Aqua fortis; hydronitrate; azotic acid; engraver's acid.

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Chromium Nitrate	13548-38-4	236-921-1	4.58
Chromium	7440-47-3	231-157-5	1

EC Classification, R/S Phrases: Refer to Section 15, Regulatory Information.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0-4): Health = 4 Fire = 0 Reactivity = 2

Major Health Hazards: Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. Chromium and chromium nitrate can irritate or damage the eyes, skin, and respiratory tract; prolonged exposure can damage the liver and kidneys. Only hexavalent chromium has been positively linked to human cancer.

Physical Hazards: The glass container may shatter. Protect from physical damage and heat.

Potential Health Effects

Inhalation:	Nitric acid, if inhaled, can damage the mucous membranes and upper respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Inhalation of chromium or chromium nitrate can irritate the upper respiratory tract.
Skin Contact:	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Chromium or chromium nitrate may be absorbed through the skin, causing the effects described for ingestion. Chromium nitrate may also cause allergic skin reactions and burns.
Eye Contact:	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Contact with chromium or chromium nitrate can cause eye irritation with tearing. Chromium nitrate solutions are corrosive and may cause eye damage.
Ingestion:	Nitric acid can cause severe burns and damage to the GI tract. Ingestion of chromium or chromium nitrate can cause abdominal pain, vomiting, and diarrhea. Prolonged exposure can damage the liver or kidneys.

Medical Conditions Aggravated by Exposure: None documented for this mixture. Both nitric acid and chromium may aggravate pre-existing disorders of the eyes, skin, and respiratory system.

Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

Note: IARC classifies trivalent chromium as Group 3 (not classifiable as to carcinogenicity in humans). Hexavalent chromium, not present in this mixture, is a known human carcinogen. Workers exposed to chromium compounds in general show an excess risk for cancer of the lung and sinonasal cavity.

4. FIRST AID MEASURES

Inhalation: Move the person to fresh air immediately. Qualified medical personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

Skin Contact: Remove contaminated clothing and shoes. Flush affected skin with water for at least 1 minute, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

Eye Contact: Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

Ingestion: Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

Note to Physician (Nitric Acid): Wash affected skin with 5% solution of sodium bicarbonate (NaHCO₂). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Chromium and chromium nitrate are negligible fire hazards when exposed to heat or flames.

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

Fire Fighting: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point (°C): N/A

Autoignition (°C): N/A

Flammability Limits in Air: N/A

Lower Explosive Limit (LEL): N/A

Upper Explosive Limit (UEL): N/A

Flammability Class (OSHA): N/A

Products of Combustion: Thermal decomposition of nitric acid can release nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), and nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of chromium nitrate may also release nitrogen oxides and other hazardous products.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Disposal: Refer to Section 13, Disposal Considerations.

7. HANDLING AND STORAGE

Storage: Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

Safe Handling Precautions: Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Nitric Acid:

ACGIH TLV-TWA: 5 mg/m³

OSHA TLV-TWA: 5 mg/m³

Chromium Nitrate:

ACGIH TLV-TWA: 0.5 mg/m³

OSHA TLV-TWA: 0.5 mg/m³ (soluble salts)

Chromium:

ACGIH TLV-TWA: 0.5 mg/m³

OSHA TLV-TWA: 1 mg/m³

Ventilation: Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

Respirator: If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

Eye Protection: Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

Personal Protection: Wear appropriate gloves and protective clothing to prevent contact with skin.

9. PHYSICAL AND CHEMICAL PROPERTIES

Nitric Acid	Chromium Nitrate	Chromium
Appearance and Odor: Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	Appearance and Odor: Pale green, extremely deliquescent powder.	Appearance and Odor: Lustrous, steel-gray metal or powder; odorless.
Relative Molecular Weight: 63.02	Relative Molecular Weight: 238.03	Relative Atomic Weight: 51.996
Molecular Formula: HNO ₃	Molecular Formula: Cr(NO ₃) ₃	Molecular Formula: Cr
Specific Gravity: 1.0543 (10%)	Specific Gravity: 1.8 (nonhydrate form)	Specific Gravity: 7.14
Solvent Solubility: Decomposes in alcohol	Solvent Solubility: Soluble in alcohol, ethyl acetate, and dimethyl sulfoxide.	Solvent Solubility: Soluble in sulfuric acid and hydrochloric acid.
Water Solubility: Soluble	Water Solubility: Soluble	Water Solubility: Insoluble
Boiling Point (°C): 86 (187°F)	Boiling Point (°C): N/A	Boiling Point (°C): 2640 (4784°F)
Melting Point (°C): -42 (-43.6°F)	Melting Point (°C): 60 (140°F)	Melting Point (°C): 1900 (3452°F)
Vapor Pressure (Pa): 946 @20°C	Vapor Pressure (Pa): Negligible	Vapor Pressure (Pa): 133 @ 1616°C
Vapor Density (Air=1): 2.17	Vapor Density (Air=1): N/A	Vapor Density (Air=1): N/A
Critical Solution Temperature: N/A	Critical Solution Temperature: N/A	Critical Solution Temperature: N/A
pH: 1.0 (0.1M solution)	pH: N/A	pH: N/A

NOTE: The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of chromium, chromium nitrate, and nitric acid. The actual behavior of the solution may differ from the individual components.

10. STABILITY AND REACTIVITY

Stability: X Stable Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Incompatible materials.

Incompatible Materials:

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Chromium and Chromium Nitrate: Incompatible with combustible materials, strong bases, mineral acids, oxidizing materials, carbonates, lithium, sulfur dioxide, halogens, peroxides, and metals.

Fire/Explosion Information: See Section 5.

Hazardous Decomposition: Thermal decomposition of nitric acid or chromium nitrate can release nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), and nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of chromium or chromium nitrate may release toxic and hazardous dusts or fumes.

Hazardous Polymerization: Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: X Inhalation X Skin X Ingestion

Nitric Acid:

Human, oral: LD_{Lo} = 430 mg/kg

Rat, oral: LD₅₀ > 90 mg/kg

Rat, inhalation: LC₅₀ (4 hrs) = 130 mg/m³

Chromium Nitrate:

Rat, oral: LD₅₀ = 3250 mg/kg

Mouse, oral: LD₅₀ = 2976 mg/kg

Chromium:

Rat, unreported route: LD₅₀ = 27,500 µg/kg

Target Organ(s):

Nitric Acid: skin, teeth, eyes, respiratory tract.

Chromium and Chromium Nitrate: kidneys, liver, respiratory tract.

Mutagen/Teratogen: Nitric acid has caused birth defects in animals under experimental conditions, and has been investigated as a possible mutagen. Exposure to hexavalent chromium has caused birth defects in animals.

Health Effects: See Section 3.

12. ECOLOGICAL INFORMATION

Nitric Acid:

Green shore crab (*Carcinus maenas*): LC₅₀ (48 hrs) = 180,000 µg/L
Starfish (*Asterias rubens*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Hooknose (*Agonus cataphractus*): LC₅₀ (48 hrs) = 100,000 to 330,000 µg/L
Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L
Cockle (*Cerastoderma edule*): LC₅₀ (48 hrs) = 330,000 to 1,000,000 µg/L

Chromium Nitrate: No ecotoxicity data were found for this specific compound. When released to land, chromium compounds bind to soil and are unlikely to migrate to groundwater. These compounds are, however, highly persistent in water as sediments. Water-soluble chromium compounds have a high potential for accumulation in aquatic life.

Chromium: Since chromium metal is not water soluble, its bioavailability is limited.

Environmental Summary: The mixture is expected to be slightly toxic to aquatic life. The environmental effects of some components have not been fully evaluated.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: One or more components of this mixture is a RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA:

Nitric Acid Solution: Hazard Class 8, UN2031, Packing Group II, Packing Instruction 807 (Excepted Qty)

15. REGULATORY INFORMATION

U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Chromium: RQ = 5000 lbs.

Chromium Nitrate: No RQ assigned (Category N090, Chromium Compounds)

Nitric Acid: RQ = 1000 lbs.

SARA Title III Section 302: Nitric acid is regulated.

SARA Title III Section 304: Nitric acid is regulated.

SARA Title III Section 313: All three components are regulated.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations (≥ 94.5%) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes
CHRONIC:	Yes
FIRE:	No
REACTIVE:	Yes
SUDDEN RELEASE:	No

State Regulations

California Proposition 65: Not regulated (only hexavalent chromium compounds are listed).

New Jersey and Pennsylvania Right to Know Lists: All three components are regulated.

CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Chromium Nitrate: C (oxidizing material), D2B (material causing other toxic effects)

Chromium: D2B (material causing other toxic effects)

WHMIS Ingredient Disclosure List: All three components are regulated.

CEPA Domestic Substances List (DSL): All three components are regulated.

EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Chromium Nitrate: XN (harmful); not listed in Annex I of Directive 67/548/EEC.

Chromium: XN (harmful); not listed in Annex I of Directive 67/548/EEC.

Risk Phrases (mixture):

R23 (toxic by inhalation)

R25 (toxic if swallowed)

R35 (causes severe burns)

R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)

S28 (wash after contact with skin)

S45 (in case of accident or illness, see doctor; show label)

S60 (dispose of this material and its container as hazardous waste)

NATIONAL INVENTORY STATUS

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

Australian Inventory of Chemical Substances (AICS): All components are listed.

Japanese Inventory of Existing and New Chemical Substances (ENCS): All components are listed.

South Korean Existing Chemicals List (ECL): All components are listed.

16. OTHER INFORMATION

Sources:

Amdur M.O., et al., *Casarett and Doull's Toxicology: The Basic Science of Poisons*. 4th Ed. New York: McGraw-Hill, 1993.

IARC Monographs, Vol. 49: Chromium.

IUCLID Dataset: Chromium. European Commission, European Chemicals Bureau, 19 February 2000.

IUCLID Dataset: Nitric Acid. European Commission, European Chemicals Bureau, 19 February 2000.

PAN Pesticide Database: Nitric Acid.

U.S. Environmental Protection Agency: Technical Factsheet on Chromium.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

U.S. National Institute of Standards and Technology, *Certificate of Analysis: Standard Reference Material® 3112a, Chromium Standard Solution*. 1 June 2004.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis